

Federal Communications Commission
Washington, D.C.

Regarding comments for:
WT Docket No. 19-116,
Notice of Proposed Rule Making and Order,
Allocation of Service Rules for the 1675-1680 MHz Band

Introduction

The FCC has requested comments regarding their proposal to allocate the spectrum between 1675 MHz and 1680 MHz for terrestrial fixed and mobile use. As an assistant professor in electrical engineering, actively working on satellite communications research at the University of North Florida (UNF) that involves the GOES L-band downlink, I would like to submit the following comments on the NPRM. The NPRM discussion section is subdivided into topics that each have multiple requests for comments. The comments submitted below are organized by the appropriate discussion section topics. The conclusions include a summary of the recommendations that are presented in the comments.

Background

At UNF we use direct satellite reception of the National Oceanic and Atmospheric Administration (NOAA) Geostationary Operational Environmental Satellite (GOES) services between 1679.7 MHz and 1694.7 MHz for research and for providing learning opportunities for both university engineering students and visiting K-12 students interested in Science, Technology, Engineering, and Mathematics (STEM). Specifically, UNF is constructing two earth stations that will be used to receive the GOES Data Collection System (DCS) downlink service and the GOES High Rate Information Transmission (HRIT) downlink service. The earth stations will be manually reconfigurable to receive GOES signals from either GOES east or GOES west to facilitate satellite communication link comparison studies. The GOES related work at UNF has also involved contracted research activities with NOAA on the GOES DCS program.

Comments on the Reallocation of 1675-1680 MHz for Non-Federal Use

Paragraph 14 of the NPRM states that the FCC is “not proposing any changes to the federal allocations”. While this is true, the proposal will have significant impact on federal users that must be understood by the NTIA and the federal users so that can identify the resources needed to absorb the impact prior to the rule making.

The NPRM seeks to distinguish between federal and non-federal users of the GOES downlink services, providing interference protection to federal users but requiring that non-federal users either accept interference from the new terrestrial non-federal services or seek an alternate means “to have access to the NOAA data”. First, the NPRM contains an error requiring correction. While HRIT data and GOES Rebroadcast (GRB) data transmitted in the spectrum adjacent to 1675-1680 MHz are NOAA data products created by NOAA and transmitted from NOAA facilities to the GOES spacecraft, the DCS data transmitted by the GOES spacecraft in the upper end of the 1675-1680 MHz spectrum and in the spectrum adjacent to it is not a NOAA data product. The DCS data is owned by federal and non-federal users and shared with NOAA. It is generated by user-owned environmental monitoring platforms, which transmit through the

GOES spacecraft and then down to earth stations which are not necessarily NOAA earth stations. While NOAA does receive all DCS user data and makes it available to the weather monitoring community and public, the reception by NOAA may be a secondary or tertiary component to a DCS user's program.

To clarify further, consider an example NOAA approved DCS user. The Florida Department of Transportation (FDOT) has deployed almost 100 DCS weather monitoring platforms for real-time public safety activities and transportation management. The FDOT DCS data is received at two redundant FDOT earth stations that can distribute the data during severe weather events (Hurricanes and Tropical Storms). The FDOT cannot use the NOAA earth stations to receive the FDOT data because during severe weather events terrestrial data telecommunication services that would relay the FDOT user data from NOAA earth stations are often compromised creating outages that can be unacceptably long. In October 2018, during hurricane Michael, the terrestrial data telecommunication services in Florida were interrupted. In the case of cellular services, the restoration delays were so long the FCC opened an investigation into the problem. However, during this same weather event, the FDOT microwave and fiber networks continued to function and the weather monitoring DCS platforms in the Florida panhandle continued to deliver their vital data before, during, and after the storm.

Another point to clarify is that it is NOAA who determines who the approved users are for the DCS program and not the FCC. By approving the FDOT, and other non-federal users, to transmit their user data through the GOES DCS transponders, alongside federal users, and by supporting their installation of non-federal DCS earth stations, NOAA has recognized the important value to environmental monitoring that they provide. By suggesting that non-federal DCS users should find an alternate means to receive their data, the FCC is, in effect, overruling the NOAA decision that approved them as a user in the first place. In many cases, like with FDOT, the approved DCS users who have made the expensive financial decision to deploy DCS earth stations were well aware of the options available and made the calculated decision to go ahead. The new delivery network, proposed by Ligado, has similar problems to the other options previously considered. Also, I do agree with University of Wisconsin's findings on its low reliability assessment for Ligado's proposed delivery network. To abandon these approved DCS users is not acceptable and the FCC should consider redrawing its federal vs non-federal user line in the sand, to at a minimum, add non-federal approved DCS users. I would like to note here that this argument does not help UNF's case as a DCS and HRIT user. It is simply the right thing to do in the interest of environmental monitoring and the NOAA DCS program and all that it does.

In paragraph 14 the FCC suggests that an allocation table footnote or rule change can be used to address the protection zones that will be needed. To the extent that the FCC is hoping to establish a finite list of fixed-dimension protection zones, neither approach would be sufficient. Even just considering federal users, the list of DCS, GRB, and HRIT earth stations is not fixed. Future, planned projects that require new deployments, or itinerant earth station deployments associated with severe weather events or disasters like wild fires will mean that the list is changing and growing. The unknown aspect of the list of sites that must be protected would make operations difficult for new terrestrial non-federal users. On short notice they could be required to cease operations at one or more sites in order to resolve an itinerant earth station interference issue. Or, having just commissioned a site, and then learning that a federal agency will be deploying a nearby earth station, the new terrestrial non-federal user must shut the new site down permanently.

An alternate method of defining protection zones would reduce this problem but it requires a modification to the NPRM. The FCC should modify the NPRM to permit only uplink use in the 1675-1680MHz band. This was done for the upper adjacent spectrum between 1695 and 1710 MHz for the AWS-3 auction. If this change is made to this NPRM there will be significant benefits to the new terrestrial non-federal user regarding the needed protection zones. First, uplink protection zones will be much smaller than downlink protection zones, increasing the economic value of an auctioned trading area. Though the NOAA interference study is not complete, previous data collected for NOAA by Microcom Design, as well as recent test data collected at Microcom Design's facilities clearly demonstrate the significant reduction in interference to the GOES applications from terrestrial cellular uplink signals compared to downlink signals. Further, if only uplink operations are permitted in the band then adding a future earth station site won't create a risk that an existing terrestrial non-federal user base station will need to be turned off.

If the FCC permits only uplink use in the 1675-1680 MHz band, then protection zones could be established by geo-fencing mobile subscriber units. With the use of multi-band phones, a mobile user would not notice that their phone had switched bands away from 1675-1680 MHz when it entered a protection zone. The geo-fencing may also be optimized. By working in coordination with GOES earth stations and actively monitoring the level of received interference at those earth station sites, the size of the protection zone could be minimized by updating geo-fencing databases used by the mobile subscribers.

Comments on Sharing and Coordination between Federal and Non-Federal Users

In Paragraph 16 the FCC asks how earth stations can share the band with new non-federal users. While the NOAA interference study is not complete and the extent of the impact of sharing the band is not yet known, some general comments can be made. Given the unpredictable nature of propagation at L-Band, in particular due to atmospheric ducting, if downlink operation is permitted in the band it is likely that protection zones will be extremely large and that there will be times when terrestrial non-federal users have to discontinue transmitting from sites beyond predicted protection zones due to long distance interference from ducting. This issue is much more impactful to DCS because it would be co-channel to the new terrestrial non-federal users, however, strong adjacent channel downlink signals will also impact GRB and HRIT by the same propagation mechanisms. There are two changes that can be made to the NPRM to help reduce this impact.

First, permitting only uplink use in the band will significantly reduce the size of the protection zones for DCS, GRB, and HRIT as well as the unknown variability of the propagation conditions for the co-channel DCS service. Even with uplink signals, the co-channel impact to DCS will not be eliminated. Terrestrial mobile units that transmit a co-channel uplink signal near a DCS earth station will cause interference to the earth station because they are operating in the same spectrum (hopefully the NOAA interference study will clarify the extent of the interference). The second change to the NPRM that is suggested to help reduce this problem is to eliminate the upper 300kHz from the spectrum to be shared. If the shared spectrum is reduced to 1675-1679.7 MHz then no overlap will exist and there will be no co-channel interference. To be clear, the threat of adjacent channel interference is still present in this scenario, in particular for DCS, as well as for GRB and HRIT, but the extent of the impact (and the size of protection zones) will be reduced. Once the NOAA interference study is complete it may be possible to accurately estimate the reduction in the size of protection zones from not sharing this upper 300 kHz of the 5 MHz in the proposal. Given the current use of terrestrial cellular channel aggregation techniques with blocks as small as 1.4 MHz and 3 MHz, it is easy to see how the slightly reduced spectrum band would still be immediately viable with off-the shelf terrestrial cellular technology by, for instance, aggregating 4.4 MHz of the band with a 3 MHz block and a 1.4 MHz block. Such a decision on how to utilize the reduced 4.7MHz of spectrum would obviously be up to the auction awardee.

In paragraph 18 the FCC asks for comments on how to coordinate future earth station sites. Having already introduced the requirement that new terrestrial non-federal users not interfere with at least federal earth stations the coordination will need to alert terrestrial non-federal users that they may need to shut down a downlink base station. If the NTIA is willing to start regulating federal receiver sites, they may be able to determine how to insert themselves into the administrative procurement process of every federal agency that is operating or desires to install a DCS, GRB, or HRIT earth station, however this is an issue the FCC and the NTIA need to discuss together. The financial resources needed to sustain this new NTIA and federal agency responsibility could be tied to FCC recurring terrestrial non-federal user license fees. One way to reduce this oversight challenge is to permit only uplink signal use in the band. The earth station protection zones will be much smaller so the coordination burden will be less since the NTIA and the federal agencies will have fewer co-primary terrestrial non-federal license holders to contact prior to commissioning their earth station. In fact, given the simple process of updating a geo-fencing database for uplink mobile units, the reduced coordination effort with uplink use could be accomplished during the earth station testing phase when the earth station is brought online and the spectrum conditions at the site are then known. Indeed, if the NTIA and FCC maintain the geo-fencing database, the onus would be on the terrestrial non-federal user to ensure they are checking the database and updating their mobile units on a regular basis. There is related precedence for this type of protection database. The FCC white

space database protects television broadcast licenses from unlicensed transmitters that must check the database for a nearby television transmitter before going on the air.

In paragraphs 19 and 20 the FCC requests comments on how to ensure non-federal users continue to receive either DCS user data or NOAA GRB and HRIT data. In addition, the FCC requests comments on how best to provide a content delivery network. One reason this is a difficult challenge to solve is that the three services have different functional requirements. For instance, while DCS data is present in the HRIT datastream, the latency of HRIT and reliability reduction associated with the second satellite link needed to transpond HRIT are why the more expensive DCS earth stations are popular with many NOAA-approved DCS users. Having established a working process, these DCS earth station users may be unwilling to consider changing to a less robust service that may or may not meet their needs. GRB has different requirements. The users of GRB are working with a high speed data service and are often using it in a highly reliable network. The GRB service has an availability requirement of 99.988% which is 5 minutes and 11 seconds of down time per month. This is more reliable than terrestrial data communications networks typically provide. In some cases commercial data services do not even recognize that a problem exists until as much as a 10 minute outage has occurred (2 failed network pings spaced 5 minutes apart). A functional requirement that is often shared by all three GOES services is the need for the service to remain active during power failures, severe weather events, and emergencies. While terrestrial telecommunication companies may provide limited power backups to their sites (8 hours is a commonly quoted specification), when the power does fail, the service outage can be for an extended period of time. This is not an acceptable scenario for a replacement to any of the three GOES services. One possible solution that may meet the requirements for both the GRB and HRIT services would be for them to be delivered through redundant fixed satellite services, most likely C band and K band. The redundant C and K band satellite services would approach the reliability of a single L-Band satellite service without the service interruption issues of terrestrial telecommunication services. Auction funds or an awardee administrative fee could be used to establish the service and to fund the migration of all verified GRB and HRIT users. From an operations standpoint NOAA should manage and pay for the new fixed satellite services with funding from annual FCC-collected, terrestrial non-federal user-paid, administrative fees. To address the possibility of awardees entering receivership and defaulting on the fee payment, the administrative fees should fund a trust that pays NOAA for the network operation from its interest.

Comments on the 1675-1680 MHz Band Plan

In paragraphs 22 and 23 the FCC discusses permitting only downlink operation and ask for comments on whether this should be changed. It should. Only uplink operation should be permitted in the band. By permitting only uplink operation the spectrum immediately adjacent to that used for NOAA earth stations will be protected from interference originating from high-powered, continuously operating, base station transmitters on both the upper adjacent spectrum (1695 - 1710 MHz) and the lower adjacent (1675 - 1680 MHz) spectrum. In addition, the terrestrial, non-federal, co-channel use of the spectrum with NOAA DCS spectrum will require large protection zones that can be reduced in size if only uplink operation is permitted. Smaller protection zones increase the economic value of the associated trading areas and will therefore also increase the spectrum auction revenue. Coordination and interference mitigation is much easier if only uplink operation is permitted. Also, new terrestrial non-federal users will not run the risk of having to shutdown a base station to mitigate interference with a current, future, or itinerant earth station. When constructing a new earth station, the coordination could be as simple as registering the site in an NTIA/FCC database a few days or weeks prior to operation. With geo-fencing of the terrestrial non-federal mobile units, protection zones could be created almost automatically by synchronizing with the NTIA/FCC database.

Conclusions

The following recommendations are included in the comments presented above:

- Treat NOAA-approved non-federal DCS users as equals with NOAA-approved federal users so they may continue to use DCS to access their own user data through protected earth stations and in the process continue to share this vital environmental data with NOAA.

- Permit only uplink operation in the 1675 – 1680 MHz band. This will reduce the size of protection zones, reduce terrestrial non-federal user risk, increase trading area value, and simplify coordination and interference mitigation.
- Do not issue a rulemaking until the NOAA interference studies are complete so that the size of protection zones is more accurately defined and trading area economic values can therefore be determined.
- Eliminate the upper 300 kHz from the 1675 – 1680 MHz to remove the co-channel interference problem.
- The FCC must engage with the NTIA to determine how to regulate and manage federal earth station sites, how to inform co-primary terrestrial non-federal users of a new planned or itinerant earth station, and how much it will cost to sustain this responsibility. Interference mitigation policies must also be agreed upon.
- Deploy a dual band, redundant, fixed satellite service-based, content delivery system for GRB and HRIT NOAA data that NOAA manages and terrestrial non-federal license holders pay for.

Should you have any further questions regarding these comments please do not hesitate to contact me.

Regards,

A handwritten signature in black ink, appearing to read 'B. Kopp' with a stylized flourish at the end.

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